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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] this invention relates to the TFT used for pixel selection of active matrix display etc.

[0002]

[Description of the Prior Art] Conventionally, the flat-panel display of the active matrix drive using amorphous silicon TFT as a switch for pixel selection is put in practical use. Furthermore, the active matrix display in which the drive circuit of the active matrix mentioned above was formed on the same substrate as a flat-panel display is also known for recently using polysilicon contest TFT.

[0003] The block diagram of this active matrix display is shown in drawing 2. In drawing, 1 is the insulating substrate (a substrate is called hereafter) which consists of glass etc., the signal circuit 2 and the scanning circuit 3 are formed in this front face, and it is formed so that two or more control signal wirings 4 and the scanning signal wiring 5 which were connected to these each may intersect perpendicularly mutually. Thereby, it ****s the front face of a substrate 1 to two or more pixel fields 6, and a display device 7 and TFT 8, such as LC, are arranged in each pixel field 6, respectively. Each gate and drain of TFT 8 are connected to the corresponding scanning signal wiring 5 and the corresponding control signal wiring 4.

[0004] namely, the contact whose scanning signal wiring 5 flows through the gate electrode 11, and this gate electrode 11 and the scanning signal wiring 5 of the L character configuration which was disconnected and formed in order to avoid the contact to the control signal wiring 4 in the intersection with the control signal wiring 4 on a manufacture, and was formed through the insulator layer (not shown) on the control signal wiring 4 as shown in the drawing 3 and the drawing 4 -- the hole 12 connects electrically. Moreover, pattern formation of the semiconductor layer 14 of the predetermined configuration prolonged in parallel with the scanning signal wiring 5 through an insulator layer 13 is carried out at the gate electrode 11 bottom prolonged in parallel with the control signal wiring 4. the end side of this semiconductor layer 14 -- a contact -- flow connection is made by the hole 15 at the control signal wiring 4 -- having -- an other end side -- a contact -- flow connection is made by the hole 16 at the display device 7

[0005] When TFT 8 shown in drawing 5 is formed and a gate signal is inputted by the gate electrode 11 and the semiconductor layer 14 from a scanning circuit 3 through the scanning signal wiring 5, the voltage currently impressed to the end side (drain) of the semiconductor layer 14 from the signal circuit 2 through the control signal wiring 4 is transmitted to an other end side (source), and is impressed to a display device 7. Thereby, the character for a display, a picture image, etc. are displayed.

[0006]

[Problem(s) to be Solved by the Invention] However, since TFT 8 was formed in the pixel field 6 and the limitation was in the active matrix display mentioned above to form thinly the control signal wiring 4 and the scanning signal wiring 5 when the field which arranges a display device 7 decreased and the display of a high definition was created, the numerical aperture of a pixel fell and there was a trouble

where the display screen became dark.

[0007] It is in the purpose of this invention offering the TFT which takes an example by the above-mentioned trouble and can reduce the occupancy area on an insulating substrate.

[0008]

[Means for Solving the Problem] this invention proposes the TFT which comes to carry out laminating arrangement of the aforementioned semiconductor layer to the intersection of the 1st aforementioned signal wiring and the 2nd aforementioned signal wiring in the TFT which has the 1st crossing signal wiring and the 2nd signal wiring which were formed on the insulating substrate, and the semiconductor layer connected to these, in order to attain the above-mentioned purpose.

[0009]

[Function] According to this invention, laminating arrangement of the semiconductor layer is carried out, and TFT is formed in the intersection of the 1st signal wiring and the 2nd signal wiring with indispensable forming on an insulating substrate.

[0010]

[Example] The example hereafter applied to the active matrix display which mentioned the TFT of this invention above is explained.

[0011] Drawing 1 is a cross section [in drawing 1 in the flat-surface block diagram and the drawing 6 showing the 1st example of this invention] of the orientation of a B-B line view. In drawing, the same component as the conventional example mentioned above is expressed with the same sign, and omits the explanation. Moreover, the difference between the conventional example and the 1st example is to have carried out laminating arrangement of the semiconductor layer 14 at the intersection of the control signal wiring 4 and the scanning signal wiring 5, and have formed TFT 8.

[0012] That is, it insulates with the scanning signal line 5, and the semiconductor layer 14 of abbreviation the configuration of L characters prolonged in the orientation which intersects perpendicularly to the scanning signal line 5 is formed in the place used as the aforementioned intersection with a polysilicon contest layer. Subsequently, it is SiO₂ to the center section of the longitudinal direction of the semiconductor layer 14. The gate electrode 11 is formed through the insulator layer 13 of a grade using contest polysilicon. At this time, it extends and the gate electrode 11 is formed so that the scanning signal wiring 5 may be met ranging over the semiconductor layer 14.

[0013] next, a this top after forming drain field 14a and source field 14b in the both ends of the longitudinal direction of the semiconductor layer 14 using ion-implantation -- SiO₂ etc. -- the position which the aforementioned drain field 14a and source field 14b are alike, respectively, and corresponds while an insulator layer 13 is *****ed -- a contact -- holes 15 and 16 -- moreover, the ends of the gate electrode 11 -- a contact -- a hole 12 is formed, respectively this time -- a contact -- a hole 16 is formed in the point of the piece perpendicularly prolonged to the control signal wiring 4, and is made not to lap with the control signal wiring 4

[0014] then, it laps with the semiconductor layer 14 by aluminum etc. -- as -- the control signal wiring 4 -- moreover, it laps with the gate electrode 11 -- as -- the scanning signal line 5 -- respectively -- forming -- a contact -- while the semiconductor layer 14 is connected with the control signal wiring 4 through a hole 15 -- a contact -- the scanning signal line 5 and the gate electrode 11 are connected through a hole 12 furthermore, the pixel field 6 (refer to the drawing 2) surrounded by the control signal wiring 4 and the scanning signal wiring 5 -- transparent electric conduction material, such as indium oxide tin (ITO), - the electrode of a display device 7 -- forming -- a contact -- it connects with source field 14b through a hole 16

[0015] As mentioned above, since laminating arrangement of forming on a substrate 1 is carried out at the intersection of the indispensable control signal wiring 4 and the scanning signal wiring 5, TFT 8 can reduce the occupancy area on a substrate. Thereby, since a display device 7 can be mostly formed in the whole region, when [of the pixel field 6] the display of a high definition is created, compared with the former, a numerical aperture can be raised sharply, and the brightness of the display screen can be raised.

[0016] Next, the 2nd example of this invention is explained. Drawing 7 is a cross section [in drawing 7

in the flat-surface block diagram and the drawing 8 showing the important section of the 2nd example] of the orientation of a C-C line view. In drawing, the same component as the 1st example is expressed with the same sign, and omits the explanation.

[0017] Moreover, the difference between the 1st example and the 2nd example is by forming the scanning signal wiring 5 using titanium (Ti) or molybdenum (Mo) to have made the scanning signal wiring 5 and the gate electrode 11 into one.

[0018] That is, the same semiconductor layer 14 as the 1st example is formed in the transposition schedule position of the control signal wiring 4 on a substrate 1, and the scanning signal wiring 5. Subsequently, it is SiO₂ to the center section of the longitudinal direction of the semiconductor layer 14. The scanning signal wiring 5 is formed with titanium or molybdenum through the insulator layer 13 of a grade. At this time, it extends and the scanning signal wiring 5 forms so that it may intersect perpendicularly with the semiconductor layer 14 ranging over the semiconductor layer 14.

[0019] next, a this top after forming drain field 14a and source field 14b in the both ends of the longitudinal direction of the semiconductor layer 14 using ion-implantation -- SiO₂ etc. -- the position which the aforementioned drain field 14a and source field 14b are alike, respectively, and corresponds while an insulator layer 13 is *****ed -- a contact -- holes 15 and 16 are formed this time -- a contact -- a hole 16 is formed in the point of the piece perpendicularly prolonged to the control signal wiring 4, and is made not to lap with the control signal wiring 4 then, it laps with the semiconductor layer 14 by aluminum etc. -- as -- the control signal wiring 4 -- forming -- a contact -- the semiconductor layer 14 is connected with the control signal wiring 4 through a hole 15 furthermore, the pixel field 6 surrounded by the control signal wiring 4 and the scanning signal wiring 5 -- transparent electric conduction material, such as indium oxide tin (ITO), -- the electrode of a display device 7 -- forming -- a contact -- it connects with source field 14b through a hole 16

[0020] Also in the 2nd example, since laminating arrangement of forming on a substrate 1 is carried out at the intersection of the indispensable control signal wiring 4 and the scanning signal wiring 5, TFT 8 can reduce the occupancy area on a substrate 1. Thereby, since a display device 7 can be mostly formed in the whole region, when [of the pixel field 6] the display of a high definition is created, compared with the former, a numerical aperture can be raised sharply, and the brightness of the display screen can be raised. Furthermore, a manufacturing process can be shortened.

[0021] Next, the 3rd example of this invention is explained. Drawing 9 is a cross section [in drawing 9 in the flat-surface block diagram and the drawing 10 showing the important section of the 3rd example] of the orientation of D-D-lines view. In drawing, the same component as the 1st example is expressed with the same sign, and omits the explanation.

[0022] Moreover, the difference between the 1st example and the 3rd example is to have formed TFT 8 in the reverse *****-** structure where the amorphous silicon was used. The formation procedure of this TFT 8 is as follows.

[0023] Namely, SiO₂ after forming the scanning signal wiring 5 in the predetermined position on a substrate 1 with titanium or molybdenum The gate insulator layer 20 of a grade is *****ed. Next, the semiconductor layer 21 of abbreviation the configuration of L characters prolonged in the orientation which intersects perpendicularly with the transposition schedule position of the control signal wiring 4 and the scanning signal wiring 5 to the scanning signal line 5 is formed by the amorphous silicon.

Subsequently, it is n+ to the both ends of the longitudinal direction of the semiconductor layer 21. A layer or p+ The drain electrode 22 and the source electrode 23 which consist of a layer are formed.

[0024] next, a this top -- SiO₂ etc. -- the position which the aforementioned drain electrode 22 and the source electrode 23 are alike, respectively, and corresponds while an insulator layer 24 is *****ed -- a contact -- holes 25 and 26 are formed this time -- a contact -- a hole 25 is formed in the point of the piece perpendicularly prolonged to the control signal wiring 4, and is made not to lap with the control signal wiring 4 then, it laps with the semiconductor layer 21 by aluminum etc. -- as -- the control signal wiring 4 -- forming -- a contact -- the semiconductor layer 21 is connected with the control signal wiring 4 through a hole 25 furthermore, the pixel field 6 surrounded by the control signal wiring 4 and the scanning signal wiring 5 -- transparent electric conduction material, such as indium oxide tin (ITO), --

the electrode of a display device 7 -- forming -- a contact -- it connects with the source electrode 23 through a hole 26

[0025] Since laminating arrangement of forming on a substrate 1 is carried out by the 3rd example at the intersection of the indispensable control signal wiring 4 and the scanning signal wiring 5, according to it, TFT 8 can reduce the occupancy area on a substrate. Thereby, since a display device 7 can be mostly formed in the whole region, when [of the pixel field 6] the display of a high definition is created, compared with the former, a numerical aperture can be raised sharply, and the display screen can be made bright.

[0026] Next, the 4th example of this invention is explained. Drawing 11 is a cross section [in drawing 11 in the flat-surface block diagram and the drawing 12 showing the important section of the 4th example] of the orientation of E-E-lines view. In drawing, the same component as the 3rd example is expressed with the same sign, and omits the explanation.

[0027] Moreover, the difference between the 3rd example and the 4th example is to have formed TFT 8 in the order *****-** structure where the amorphous silicon was used. The formation procedure of this TFT 8 is as follows.

[0028] That is, a predetermined spacing is opened in the orientation in which the control signal wiring 4 is prolonged in the transposition schedule position of the control signal wiring 4 on a substrate 1, and the scanning signal wiring 5, and it is n+. A layer or p+ The drain electrode 22 and the source electrode 23 which consist of a layer are formed. At this time, it forms so that a part of source electrode 23 may not lap with the control signal wiring 4. Then, the semiconductor layer 21 is formed ranging over the drain electrode 22 and the source electrode 23.

[0029] Furthermore, it is SiO₂ to the center section of the longitudinal direction of the semiconductor layer 21. The scanning signal wiring 5 is formed with titanium or molybdenum through the insulator layer 24 of a grade. At this time, it extends and the scanning signal wiring 5 forms so that it may intersect perpendicularly with the semiconductor layer 21 ranging over the semiconductor layer 21.

[0030] next, a this top -- SiO₂ etc. -- the position which the aforementioned drain electrode 22 and the source electrode 23 are alike, respectively, and corresponds while an insulator layer 24 is *****ed -- a contact -- holes 25 and 26 are formed this time -- a contact -- a hole 26 is formed in the fraction which does not lap with the control signal wiring 4 then, it laps with the semiconductor layer 21 by aluminum etc. -- as -- the control signal wiring 4 -- forming -- a contact -- the semiconductor layer 21 is connected with the control signal wiring 4 through a hole 24 furthermore, the pixel field 6 surrounded by the control signal wiring 4 and the scanning signal wiring 5 -- transparent electric conduction material, such as indium oxide tin (ITO), -- the electrode of a display device 7 -- forming -- a contact -- it connects with the source electrode 23 through a hole 26

[0031] Since laminating arrangement of forming on a substrate 1 is carried out by the 4th example at the intersection of the indispensable control signal wiring 4 and the scanning signal wiring 5, according to it, TFT 8 can reduce the occupancy area on a substrate. Thereby, since a display device 7 can be mostly formed in the whole region, when [of the pixel field 6] the display of a high definition is created, compared with the former, a numerical aperture can be raised sharply, and the brightness of the display screen can be raised.

[0032] In addition, in this example, since the area on the aforementioned insulating substrate which can form other components can be increased when it is not limited to this and it applies to other equipments, although explained to active matrix display with the application of the TFT of this invention, integration of equipment (electronic circuitry) can be raised further.

[0033]

[Effect of the Invention] As explained above, since laminating arrangement of the semiconductor layer is carried out and TFT is formed in the intersection of the 1st signal wiring and the 2nd signal wiring with indispensable forming on an insulating substrate, according to this invention, the area on the aforementioned insulating substrate which can form other components can be increased. Thereby, when the aforementioned TFT is used for active matrix display, the numerical aperture of a pixel can be raised sharply and brightness can be raised also in the display of a high definition. Moreover, when it uses for

other equipments, the effect which was very much excellent that integration of equipment (electronic circuitry) can be raised further is done so.

[Translation done.]